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Benchmark Specification for Intercomparisons of Thick Target Calculations for Transmutation Purposes

Particle Beam

- particle type: protons
- beam energy: 800 MeV
- beam profile: pencil beam on target axis (mid point of target at r = 0) (s. att. figure)

Target

- materials*: lead of density = 11.34 g/cm^3
  tungsten of density = 19.30 g/cm^3
  (for simplicity reasons Pb-208 and W-186 should be used)
  *(Reactor Handbook, Vol. I, Materials, Interscience Publishers, New York, 1960)
- geometry: cylindrical
  diameter = 20 cm
  length = 60 cm
  (see att. figure and table for the mesh-grid)
  outside target vacuum should be provided
- neutron transport cross sections: group cross sections below 20 MeV, temperature 300°K, infinite diluted

Particle Transport Codes

Different versions of HETC or other thick target spallation physics codes; low energy neutron transport (≤20 MeV) using Monte Carlo methods (MORSE, MCNP etc.) or using deterministic methods like S_N-transport etc.
(All codes should be briefly described for better understanding of possible differences in the calculated results. State, origin and date of release of used codes should be specified (e.g. high energy fission, elastic scattering of high energy neutrons and protons is included etc.))

Quantities to be calculated

1. Total neutron yields per proton (neutrons per source proton and per second) and neutron yield spectra (neutrons per group interval per proton and per second) over whole target.
(Energy group boundaries in MeV for yield spectra 0.0; 0.5; 1.0; 2.0; 3.0; 4.0; 5.0; 8.0; 10.0; 12.5; 15.0; 20.0; 25.0; 50.0; 75.0; 100.0; 150.0; 200.0; 250.0; 400.0; 500.0; 600.0; 700.0; 800.0)

2. Total neutron flux leakage distributions for neutrons above and below 20 MeV of all surface sections provided by the mesh grid (s. figure).
(Neutron flux per cm^2 and sec per source proton per sec plotted as neutron flux as a function of lethargy, i.e. energy in logarithmic scale.)

3. Spallation product yield distributions over A and Z in the meshes (also integrated over whole target) (s. figure).
(Plotted in log. linear scale.) Also tables for the yield distributions should be provided.
a) after beam shutoff
b) after 1 year and after 100 years

- remark: irradiation time is zero; normalization of results per one beam proton and second

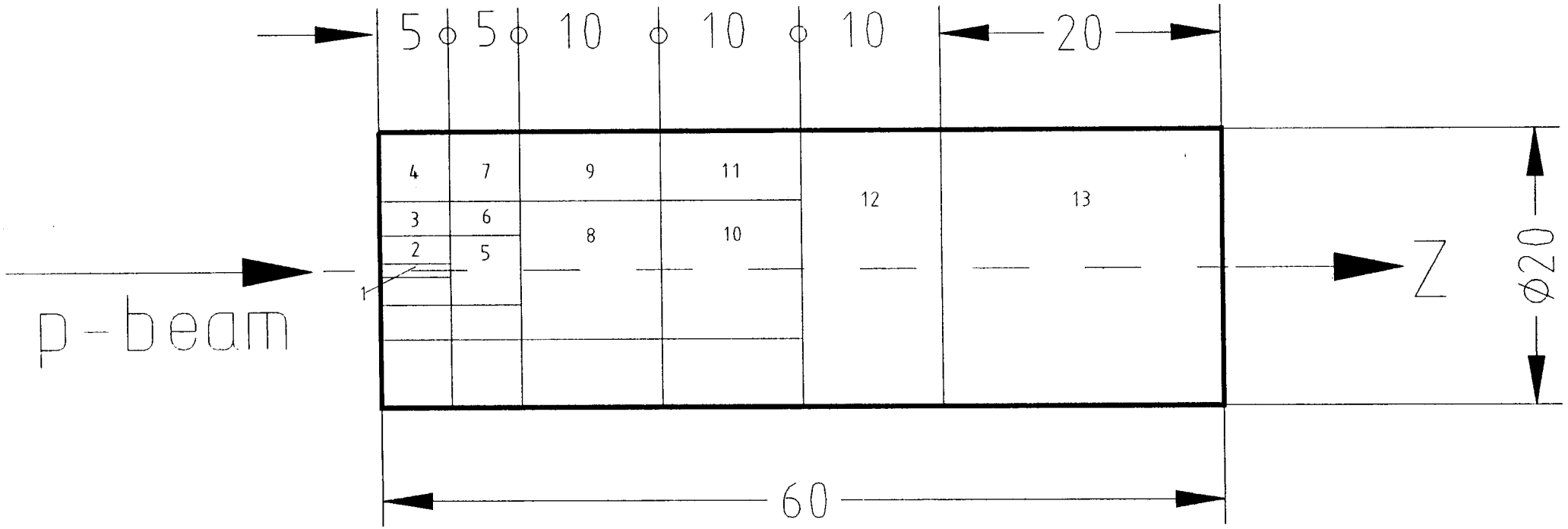
Results for Intercomparison (which should at least be provided)

- Neutron leakage distribution of all surface sections in given meshes (4, 7, 9, 11, 12, 13)
- Spallation product distributions integrated over whole target and in meshes No. 1-13 at beam shutoff (s. att. figure)

Table for the Mesh-Grid of the Geometry

No.
1: r = 0.0 - 0.5 cm, length = 5.0 cm
2: r = 0.5 - 2.5 cm, "
3: r = 2.5 - 5.0 cm, "
4: r = 5.0 - 10.0 cm, "
5: r = 0.0 - 2.5 cm, length = 5.0 cm
6: r = 2.5 - 5.0 cm, "
7: r = 5.0 - 10.0 cm, "
8: r = 0.0 - 5.0 cm, length = 10.0 cm
9: r = 5.0 - 10.0 cm, "
10: r = 0.0 - 5.0 cm, length = 10.0 cm
11: r = 5.0 - 10.0 cm, "
12: r = 0.0 - 10.0 cm, length = 10.0 cm
13: r = 0.0 - 10.0 cm, length = 20.0 cm

Geometry for calculations



PARTICIPATION FORM

International Code and Model Intercomparison for Intermediate Energy Reactions

Please return this form at your earliest convenience to:

P. Nagel
Nuclear Energy Agency
Le Seine-Saint Germain
12, boulevard des Iles
92130 Issy-les-Moulineaux

I am participating or intend to participate in phase 1 yes: ☐ no: ☐

I intend to participate in phase 2 yes: ☐ no: ☐

Name:

Electronic network address: